**Topics 05 - Energetics (SL/HL 1)**

**Topic 5: Energetics (8 hours)**  
  
**5.1 Exothermic and endothermic reactions - 1 hour**  
5.1.1 Define the terms exothermic reaction, endothermic reaction and standard   
enthalpy change of reaction ∆H (1)   
5.1.2 State that combustion and neutralization are exothermic processes. (1)   
5.1.3 Apply the relationship between temperature change, enthalpy change and the classification of a reaction as endothermic or exothermic. (2)   
5.1.4 Deduce, from an enthalpy level diagram, the relative stabilities of reactants and products, and the   
sign of the enthalpy change for the reaction. (3)   
**5.2 Calculation of enthalpy changes - 3 hours**   
5.2.1 Calculate the heat energy change when the temperature of a pure substance is changed. (2)   
5.2.2 Design suitable experimental procedures for measuring the heat energy changes of reactions. (3)   
5.2.3 Calculate the enthalpy change for a reaction using experimental data on temperature changes, quantities of reactants and mass of water. (2)   
5.2.4 Evaluate the results of experiments to determine enthalpy changes. (3)   
**5.3 Hess’s law - 2 hours**  
5.3.1 Determine the enthalpy change of a reaction that is the sum of two or three reactions with known enthalpy changes. (3)   
**5.4 Bond enthalpies - 2 hours**  
5.4.1 Define the term average bond enthalpy. (1)   
5.4.2 Explain, in terms of average bond enthalpies, why some reactions are exothermic and others are   
endothermic. (3)   
  
**Topic 15: Energetics (8 hours)**  
  
**15.1 Standard enthalpy changes of reaction - 1.5 hour**   
15.1.1 Define and apply the terms standard state, standard enthalpy change of formation   
ΔHof and standard enthalpy change of combustion   
ΔHoc. (2)   
15.1.2 Determine the enthalpy change of a reaction using standard enthalpy changes of formation and   
combustion. (3)   
**15.2 Born–Haber cycle - 2.5 hours**   
15.2.1 Define and apply the terms lattice enthalpy and electron affinity. (2)   
15.2.2 Explain how the relative sizes and the charges of ions affect the lattice enthalpies of different ionic compounds. (3)   
15.2.3 Construct a Born–Haber cycle for group 1 and 2 oxides and chlorides, and use it to calculate an enthalpy change. (3)   
15.2.4 Discuss the difference between theoretical and experimental lattice enthalpy values of ionic compounds in terms of their covalent character. (3)   
**15.3 Entropy - 1.5 hours**   
15.3.1 State and explain the factors that increase the entropy in a system. (3)   
15.3.2 Predict whether the entropy change (ΔS) for a given reaction or process is positive or negative. (3)   
15.3.3 Calculate the standard entropy change for a reaction (ΔS) using standard entropy values(s) . (2)   
**15.4 Spontaneity - 2.5 hours**   
15.4.1 Predict whether a reaction or process will be spontaneous by using the sign of ΔG. (3)   
15.4.2 Calculate ΔG for a reaction using the equation ΔG= ΔH−TΔS and by using values of the standard free energy change of formation, ΔGf . (2)   
15.4.3 Predict the effect of a change in temperature on the spontaneity of a reaction using standard entropy and enthalpy changes and the equation ΔG = ΔH − TΔS. (3)